

## Claims

- [c1] What is claimed is:
1. A method for motion estimation in video compression, the method comprising:
    - selecting a plurality of search locations within a search window;
    - generating a match-value for each search location indicating how closely each search location matches a reference block;
    - generating a plurality of level-values based on first dispositional relationships of the search locations and the relative magnitudes of the match-values;
    - generating a preliminary motion vector based on the level-values;
    - generating a plurality of candidate results based on second dispositional relationships of the search locations and the relative magnitudes of the match-values; and
    - generating a final motion vector by altering the preliminary motion vector according to the candidate results as indicated by a predetermined set of formulas.
  - [c2] 2.The method of claim 1 wherein the search locations are selected according to a predetermined table comprising a first column, a second column, and a plurality of rows, each row in the table specifying a unique search location.
  - [c3] 3.The method of claim 2 wherein the table is an orthogonal table generated using the statistical model  $x = \mu + A + B + C + D + A \times B + A \times C + B \times C + \epsilon$  where  $\epsilon$  is an error factor, and  $\mu$  is an average of  $A$ ,  $B$ ,  $C$ ,  $D$ ,  $AB$ ,  $AC$ , and  $BC$ , the orthogonal table having columns  $A$ ,  $B$ ,  $C$ , and  $D$ .
  - [c4] 4. The method of claim 3 wherein the column  $A$  equals the most significant bit of an  $X$  coordinate in the search window, the column  $B$  equals the second most significant bit of the  $X$  coordinate in the search window, the column  $C$  equals the most significant bit of a  $Y$  coordinate in the search window, the column  $D$  equals the second most significant bit of the  $Y$  coordinate in the search window.
  - [c5] 5. The method of claim 2 wherein generating the candidate results comprises separately summing the match-values of the search locations having a third value in the first column and the third value in the second column, having the

third value in the first column and a fourth value in the second column, having the fourth value in the first column and the third value in the second column, and having the fourth value in the first column and the fourth value in the second column, and selecting the smallest sum as the candidate result.

[c6] 6. The method of claim 2 wherein the level-values comprise, for each column in the predetermined table, a first level-value being a sum of the match-values of the search locations having a first value in that column, a second level-value being a sum of the match-values of the search locations having a second value in that column, and a third level-value being the absolute difference between the first level-value and the second level-value.

[c7] 7. The method of claim 6 wherein the preliminary motion vector comprises a plurality of bits representing an X coordinate within the search window and a plurality of bits representing a Y coordinate within the search window, the most significant bit of the X coordinate of the preliminary motion vector is the first value if the first level-value of the first column is less than the second level-value of the first column and the most significant bit of the X coordinate of the preliminary motion vector is the second value if the first level-value of the first column is not less than the second level-value of the first column, the Y coordinate of the preliminary motion vector is the first value if the first level-value of the second column is less than the second level-value of the second column and the most significant bit of the Y coordinate of the preliminary motion vector is the second value if the first level-value of the second column is not less than the second level-value of the second column.

[c8] 8. The method of claim 6 wherein the final motion vector comprises a plurality of bits representing an X coordinate within the search window and a plurality of bits representing a Y coordinate within the search window, the candidate results being used to generate the most significant bit of the X coordinate of the final motion vector when indicated by the predetermined set of formulas and the candidate results being used to generate the most significant bit of the Y coordinate of the final motion vector when indicated by the predetermined set of formulas.

- [c9] 9. The method of claim 1 wherein generating the match-values comprises calculating the sum of the absolute differences in brightness between each pixel in the reference block and a corresponding pixel in the search location to generate the match-value for that search location.
- [c10] 10. A device for motion estimation in video compression, the device comprising:  
a control circuit for executing computer code; and  
a memory comprising:  
computer code that determines a plurality of search locations within a search window;  
computer code that compares a reference block with each search location and generates a match-value for each search location indicating how closely each search location matches the reference block;  
computer code that generates a plurality level-values based on a first dispositional relationship of the search locations and the relative magnitudes of the match-values;  
computer code that generates a preliminary motion vector based on the level-values;  
computer code that generates candidate results based on a second dispositional relationship of the search locations and the relative magnitudes of the match-values; and  
computer code that generates a final motion vector by altering the preliminary motion vector according to the candidate results as indicated by a predetermined set of formulas.
- [c11] 11. The device of claim 10 wherein the memory further comprises a predetermined orthogonal table having a first column, a second column, and a plurality of rows, each row in the table specifying a unique search location.
- [c12] 12. The device of claim 11 wherein the orthogonal table is conformal with the statistical model  $x = \mu + A + B + C + D + A \times B + A \times C + B \times C + \epsilon$  where  $\epsilon$  is an error factor, and  $\mu$  is an average of  $A$ ,  $B$ ,  $C$ ,  $D$ ,  $AB$ ,  $AC$ , and  $BC$ .
- [c13] 13. The device of claim 11 wherein the level-values comprise, for each column in the predetermined table, a first level-value being a sum of the match-values

of the search locations having a first value in that column, a second level-value being a sum of the match-values of the search locations having a second value in that column, and a third level-value being the absolute difference between the first level-value and the second level-value.

- [c14] 14. The device of claim 13 wherein the preliminary motion vector comprises a plurality of bits representing an X coordinate within the search window and a plurality of bits representing a Y coordinate within the search window, the most significant bit of the X coordinate of the preliminary motion vector is the first value if the first level-value of the first column is less than the second level-value of the first column and the most significant bit of the X coordinate of the preliminary motion vector is the second value if the first level-value of the first column is not less than the second level-value of the first column, the Y coordinate of the preliminary motion vector is the first value if the first level-value of the second column is less than the second level-value of the second column and the most significant bit of the Y coordinate of the preliminary motion vector is the second value if the first level-value of the second column is not less than the second level-value of the second column.

- [c1 5] 15. The device of claim 13 wherein the final motion vector comprises a plurality of bits representing an X coordinate within the search window and a plurality of bits representing a Y coordinate within the search window, the candidate results being used to generate the most significant bit of the X coordinate of the final motion vector when indicated by the predetermined set of formulas and the candidate results being used to generate the most significant bit of the Y coordinate of the final motion vector when indicated by the predetermined set of formulas.

- [c16]
16. A computer readable media used for motion estimation in video compression, the computer readable media comprising:
- computer code that determines a plurality of search locations within a search window;
- computer code that compares a reference block with each search location and generates a match-value for each search location indicating how closely each

search location matches the reference block;  
 computer code that generates a plurality level-values based on a first  
 dispositional relationship of the search locations and the relative magnitudes of  
 the match-values;  
 computer code that generates a preliminary motion vector based on the level-  
 values;  
 computer code that generates candidate results based on a second dispositional  
 relationship of the search locations and the relative magnitudes of the match-  
 values; and  
 computer code that generates a final motion vector by altering the preliminary  
 motion vector according to the candidate results as indicated by a  
 predetermined set of formulas.